United Nations Industrial Development Organization

Distr.
LIMITED

ID/WG.445/2
12 August 1985

ENGLISH

International Conference on Synthetic Fibres
Beijing, China, 18 - 22 November 1985

# SYNTHETIC FIBRE INDUSTRY IN TURKEY*

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** Petkim Petrochemical Co. Yarimca Complex

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## INTRODUCTION

Since early sixties, synthetic fibre industry has grown up rapidly in Turkey. For a long time conventional naturel fibres were used in textile industry. In the mid of the fifties, rayon, the cellulosic fibre appeared. Eventhough its raw material had been wood and cotton cellulose, this was the first synthetic fibre in our domestic market. It was called "Artificial Silk".

In sixties, the synthetic fibre which was produced from petrochemical raw materials was begun to be used in textile industry and each year the synthetic fibre usage has increased.

Nowadays, textile products takes an important place in Turkey's export potential. It means that the synthetic fibre industry will keep its importancy in the future.

## SYNTHETIC FIBRES

In the synthetic fibre industry of Turkey there are mainly for different kind of fibres use.

They are;

a) Cellulosic fibre,

b) Polyamide fibre,

c) Acrylic fibre,

d) Polyester fibre,

## CELLULOSIC FIBRE

Cellulosic fibre is practically different from other synthetic fibres. The raw material which is used for producing fibre is cellulose. As it is known cellulose is obtained naturally. Also cellulose itself can't be used as fibre. Some chemical reactions take place for in producing fibre. This cellulosic fibre is called artificial silk in domestic appliance.

Sümerbank, the state company owned a cellulosic fiber plant. After extensions the capacity of this plant is approxiametely 6000 tons/year.

∝ cellulose, the raw material is imported mainly from Finland and Sweden.

The reaction of an alkali cellulose with carbon disulfide to form cellulose xanthate (the cellulose monoester of unstable dithiocarbonic acid, $H_2COS_2$) forms the basis of the viscose process industry.

Chemically, the reaction is a heterogeneous esterification of the hydroxyl groups of an alkali cellulose by carbon disulfide in vapor form. The resulting xanthate will dissolve smoothly in dilute alkali to form a viscose spinning solution of good filterability. Viscose in turn, yields regenerated cellulose fibres into an acid coagulating and regenerating bath.

The product rayon fibre is called commonly "artificial silk" in our country. Rayon fibres is mixed to a some degree with natural fibres in textile industry.

## POLYAMIDE FIBRES

Polyamide type of synthetic fibres are produced wholly by private companies.

Filament Sentetik A.Ş. owned a Nylon 6,6 fibre plant. It's capacity is approximately 5000 tons/year. By 1985 the plant's capacity will increase to 15000 tons/year. The company uses Zimmer licence.

For producing Nylon 6,6 , the raw material is imported, because there is no domestic production.

Polyamides of this kind are widely used as textile fibers for wearing apparel, as cord for reinforcement of heavy-duty tires.

SIFAŞ, INSA and TEKSTIPLIK private companies involve with the production of Nylon 6 or polycaprolactam.

Sifaş has 10000 tons/year production capacity, Insa has 6000 tons/year and Tekstiplik Co. has 4000 tons/year production capacity.

There are several satisfactory commercial ways to produce polycaprolactam. (Nylon 6). In one method, $\varepsilon$- aminocapronic acid is used as catalyst. Molten caprolactam with 1-5 percent catalyst is heated at atmospheric pressure at 240-280 $^{o}$C for 6-8 hours. In another method an aqueous solution of caprolactam is heated under pressure in an autoclave. No catalyst is used since some hydrolys takes place to produce aminocapronic acid.

One method makes use of alkali-metal catalyst under anhydrous conditions. Molten caprolactam polymerizes very rapidly in the presence of sodium or lithium catalyst.

Polycaprolactam (melting point 215 $^{o}$C) is melt spun into filaments.

For producing Nylon 6, caprolactam is used as raw material. In Turkey caprolactam is produced by Petkim Petrochemical Co. Petkim is a State Company. Petkim has two complexes. One is located in Yarımca/Kocaeli and another is in Aliağa/Izmir.

In Yarımca complex, there is a caprolactam plants group. This group consists 5 different plants. The caprolactam production capacity is 25000 tons/year. The licences of these 5 plants are belong to Inventa Ems and Ube. These 5 plants are as follows;

a) Cyclohexane plant,

b) Cyclohexanone plant,

c) Oleum/$SO_2$ plant,

d) Caprolactam plant,

e) $(NH_4)_2SO_4$ plant,

The raw materials for this process benzene, ammonia, elementel sulphure and naphta. All these raw materials are supplied domestically.

In cyclohexane plant, naphta is used for producing $H_2$ and $CO_2$. In this plant benzene has converted to cyclohexane by hydrogenation in the presence of Nickel catalyst.

Cyclohexane is oxidised by air directly after some reaction stages, and cyclohexanone is produced.

Lactam plant has different units. Ammonia, $SO_2$ and cyclohexanone are used in chemical reactions for producing lactam. $SO_2$ is supplied from Oleum/$SO_2$ plant. For producing $SO_2$, elementel sulphure is burned. The final product, caprolactam is filled to polyethylene bags as flakes.

$(NH_4)_2SO_4$ solution which is derived from lactam plant is sent to $(NH_4)_2SO_4$ plant. With a vaporisation process concentrated $(NH_4)_2SO_4$ is produced and sold as fertilizer.

Production of caprolactam monomer is as follows,

| Year | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|---|---|---|---|
| Tons | 5278 | 14479 | 13216 | 16448 | 14886 | 14433 | 18991 | 9414 | 8952 |

In textile industry 50 per cent of Nylon 6 is used for producing muss nylon. After texturizing process Nylon 6 is converted to muss nylon. Muss nylon is used especialy for manufacturing of socks and stockings. Nylon 6 fibre is also used for manufacturing clothings, carpet and blankets.

## ACRYLIC FIBRES

Acrylic fibre production is achieved by two private companies. AKSA and Yalova Akrilik A.Ş.

The raw material ACN polymerised by various techniques. ACN is a stable monomer exhibiting little tendency toward purely thermal polinerization, but it can be polymerized readily using catalysts or various types of radiation. Peroxides have been used to initiate the free radical polymerization of acrylonitrile.

Acrylic fibers are spun from solvents, either by direct evaporation or by use of a coagulating bath. Principal uses are in suits and other woven fabrics, in jersey knit goods, in sweaters and in blankets. Acrylic have outstanding resistance to sunlight, insects, and chemicals. They have high sticking temparatures, warm feel, good dimensional stability, and low moisture absorbtion. They can be used alone, as in sweaters, but are often blended with wool or with rayon.

Because there is no domestic ACN production yet, the whole ACN demand is inported.

AKSA and Yalova Akrilik A.Ş. has started-up their plants in mid seventies. ACN consumption for producing acrylic fibre of bath plants are as follows.

| | | |
|---|---|---|
| 1976 | 28000 | tons |
| 1977 | 38000 | " |
| 1980 | 44000 | " |
| 1984 | 57000 | " |

82000 tons of demand would be expected in the year 1987.

In Petkim Aliağa/İzmir Complex a new ACN plant will be on stream very soon.It has 70000 tons/year capacity. ACN will be produced by Sohio process. Propylene and ammonia are oxidised by air in the presence of catalyst. This reaction is called ammoxidation.

Raw materials, propylene and ammonia will be supplied domestically.

Turkey's ACN demand prediction is as follows,

| | | |
|---|---|---|
| 1986 | 79300 | tons |
| 1987 | 87700 | " |
| 1988 | 96500 | " |
| 1989 | 105700 | " |
| 1990 | 115400 | " |

# POLYESTER FIBRES

Polyester fibre can be produced from dimethylterephatlate and pure terephtalic acid. Because there were some technological difficulties for producing PTA, DMT is seemed prefferable raw material in textile industry. But in last 10 - 15 years, new developments were obtained in production technology of PTA, and it had won its place as a raw material for synthetic fibre industry.

In Aliağa Petrochemical complex a new pure terephtalic acid plant will be on stream soon.

It has 70000 tons/year capacity and Amoco licence is chosen for this plants

P.xylene is used as raw material for Amoco process. P.xylene is oxidised to terephtalic acid directly in the presence of NaBr. Cobalt and Manganase acetates are used as catalysts for the reaction.

SANCAK Tül is a private company that uses TPA for producing polyester fibre.Dimethylterephatlate is the most important raw material for producing polyester fibre.

DMT is produced by a private company SASA. After its extention, SASA has 120000 tons/year capacity. DMT is produced by Dynamit Nobel process.

The feed for the process, p.xylene is imported, but very soon in Petkim Aliağa Complex P.xylene will be produced from aromatic extraction plant.

P.xylene, in the presence of heavy metal catalysts oxidised by air to P.toluic acid and monomethylterephtalat. Then these acids oxidised to P.methyltoluate and DMT.

DMT polycondansated and polyester fibre is produced.

SASA, also has synthetic fibre facilities. Its capacity is approxiametely 80000 tons/year and Dupont process is used.

DMT consumption figures are as follows.

| Years | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|---|---|
| Cosumption | 42781 | 53427 | 59232 | 66195 | 69796 | 79689 | 89855 |

Both DMT and TPA originated synthetic fibres have a big potential in domestic market and for export.